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ABSTRACT

The New York Collaborative for Excellence in Teacher Preparation (NYCETP) is a multi-campus project designed to produce competent science and mathematics teachers. Ongoing formative evaluation included documenting NYCETP meetings and conferences, providing feedback summaries on conferences and working groups, and evaluating course conversion and course enhancement documents. The evaluation helped design activities supporting faculty development and intercampus faculty collaboration. Evaluation activities included examining a course developed by faculty on a different campus. Peer review procedures were developed for NYCETP course and curriculum materials. The peer review process included a lesson plan review form for mathematics methods courses (faculty rated preservice teachers' lesson plans). Questionnaires were developed to examine student, faculty, and administrator familiarity with NYCETP goals. A sixth-year extension involved participating in the National Science Foundation CETP Core Evaluation and Data Collection Project, summarizing NYCETP data, and planning for an integrated student database and tracking system. A 3-year evaluation proposal was developed to coordinate NYCETP data collection goals with City University of New York efforts to generate a longitudinal database for preservice teachers on all campuses, with placement and follow-up information aligned with New York and National Council for Accreditation of Teacher Education accreditation requirements. (Contains 17 references.) (SM)

FINAL REPORT

Internal Evaluation of the

New York Collaborative for Excellence in Teacher Preparation

Center for Advanced Study in Education
The Graduate School and University Center
of the City University of New York

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New York Collaborative for Excellence in Teacher Preparation

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Abstract

The New York Collaborative for Excellence in Teacher Preparation (NYCETP) is a multi-campus project designed to produce well-qualified teachers of science and mathematics. The Center for Advanced Study in Education (CASE) carried out a number of procedures for evaluation of NYCETP. On-going formative evaluation activities during the five years of the project included attending and documenting NYCETP meetings and conferences, providing feedback summaries on conferences and working groups, and evaluating the course conversion and course enhancement documents. One of the main goals of the evaluation was the design of activities that supported faculty development and intercampus faculty collaboration. These evaluation activities started with the use of case study methods in which a faculty member studied a course developed by faculty on a different campus. The process was expanded with the development and use of peer review procedures for course and curriculum materials designed for NYCETP. Another evaluation study expanded the peer review process of faculty course materials to the use of a lesson plan review form for education mathematics methods courses, with faculty rating teacher education students' lesson plans. Survey questionnaires were developed and piloted to examine student, faculty, and administrator familiarity with NYCETP goals.

A project sixth-year extension provided resources to participate in the NSF CETP Core Evaluation and Data Collection Project, to summarize the NYCETP data, and to plan for an integrated student data base and tracking system. These resources were also used to develop a three-year evaluation proposal that coordinates the NYCETP data collection goals with the CUNY-wide effort to develop a longitudinal data base for teacher education students on all campuses, including placement and follow-up information in line with both New York state and NCATE accreditation requirements.

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I. Introduction and Procedures

The New York Collaborative For Excellence in Teacher Preparation (NYCETP) was a project involving five campuses of the City University of New York (CUNY) and New York University (NYU). The goal of the Collaborative was stated as, to produce "well-qualified teachers of science and mathematics for New York City schools and to increase the number of individuals who enter and successfully complete teacher preparation requirements in science and mathematics." The Collaborative efforts to meet this main objective were presented in six clusters of activities: (1) Rethinking college instruction—methodology and structures; (2) Developing new courses and programs; (3) Developing new curriculum materials; (4) Providing student supports and career development; (5) Recruiting promising students into teaching; and (6) Developing exemplary field sites.

The internal evaluation of the NYCETP was carried out by the Center for Advanced Study in Education (CASE) of the Graduate Center of CUNY. During the first three years of the project CASE focused on several evaluation activities. These included documentation and formative feedback on collaborative workshops and conferences, on-going consultation on collaborative goals, and implementation of particular activities such as the workshops. For a few individual faculty the evaluators provided technical assistance in conducting a pre-post course survey of student attitudes toward mathematics, Views about Sciences Survey, and a student survey in biology (see Pape, Tittle, & Flugman, 1999).

In late spring of the first year the evaluators decided to focus evaluation activities on two key NYCETP project goals: (1) faculty development; and (2) intra and intercampus collaboration in developing courses and curriculum materials. We developed and carried out procedures for NYCETP faculty to conduct cross-campus case studies of courses being revised and/or developed by other NYCETP faculty participants (Tittle, Pape, & Flugman, 2000). As part of the case study evaluation project, the case study process was formalized to some degree, involving an outline for the case study and a peer review form designed to describe and evaluate the case-studied courses, as well as other courses revised by faculty in the collaborative (Pape & Tittle, 1998). The peer review form (Self-Study Guidelines) included check lists and ratings on whether course documents and curriculum met the collaborative student-centered instructional goals, course content goals, course/materials minimum expectations, and evidence of effectiveness of goals in mathematics and/or science, including student attitudes or other outcomes. A glossary of terms accompanied the Guidelines (Pape & Tittle, 1998). These forms drew on earlier reviews of assessment and evaluation of mathematics and science teaching reform in classrooms (Tittle & Pape, 1995, 1996) and the national standards in mathematics and science.

The work with the course Self-Study Guidelines was extended to a procedure to evaluate student lesson plans prepared by mathematics teacher education students. The procedures were tried out in a pilot study (Scheiner & Tittle, 2000), and are described briefly below ((III.B.) . The peer review process in the case studies was used to support the Collaborative goals of cross-campus collaboration, cross discipline study, and faculty development linked to the instructional process. The case studies dealt with science and mathematics courses that were content focused, and the lesson plan study focuses on education students in teaching methods classes and on evaluating their lesson plans using NCTM Standards.

In summary, the evaluation of the NYCETP used activities designed to provide direct feedback to project directors and faculty participants about workshops and conferences, about course curricula and materials that were developed, and about using national mathematics and science standards to evaluate student lesson plans. These activities involved procedures of: direct observation; developing, summarizing, and reporting results of "feedback" questionnaires; documenting attendance and participation in meetings; attending project planning meetings and reporting findings; drawing on and adapting procedures for case studies so that faculty could study another faculty member's course; designing peer review forms for faculty to evaluate course materials; and adapting the peer review forms for use with student-developed lesson plans. All of these evaluation activities and procedures are included in the annual reports for years 1-4, and were submitted with the project annual reports and reports to the National Visiting Committee. Sections II and III, below, provide descriptions or examples of these activities and findings. Section IV describes the work of the Sixth Year Extension and the Three Year Evaluation Proposal. References to project reports and ERIC documents are included.

II. Documentation and feedback for conferences and workshops

The CASE annual evaluation reports for the first four years of the project provide summaries of the documentation and feedback provided to the project directors based on participant responses to questionnaires. Year one (1995-96) provided data based on four faculty workshops and two larger conferences that included public school personnel as well as faculty. Year 2 (1996-97) included responses to four meetings of the faculty working groups and one large conference (held at the New York Hall of Sciences) (Pape, Tittle, & Flugman, 1999). Year 3 (1997-1998) included several meetings of the curriculum groups and a large conference held at the American Museum of Natural History (Tittle, 1998). Year 4 included two large conferences, both held at the New York Academy of Sciences: Issues facing mathematics and science teacher preparation (winter); and Meeting the new Regents requirements (fall) (Tittle, 1999). The Year 4 conferences were a response to changes in the New York State procedures and requirements for teacher preparation and certification. (A pilot study of a technology survey was also carried out and described in the Year 4 report.) Year 5 activities focused on dissemination, and did not involve formal meetings of the working groups or a large conference.

As an example of the type of feedback provided by faculty attending workshops, a summary of the suggestions and comments for future workshops was made based on Year 1 workshops (Pape, Tittle & Flugman, 1999). Participant comments reflected a general need for practical workshops, with content that could be readily used by faculty in their attempts to revise their own practice. Workshops that presented hands-on experiences were received most favorably and many of these sessions provided ideas that faculty felt they could implement in their own classrooms. Faculty also requested smaller, more concentrated group discussions of issues related to course revisions. Specifically, faculty suggestions for future workshops included the following:

1. Strategies for college faculty to change instruction to a more inquiry-based or problem solving model.

2. Sessions that allowed ample time to interact with materials and computer software, including the internet.

3. Greater facilitation of the collaborative process between and within campuses through joint presentations.

4. Joint workshops with NYC public school personnel to investigate similarities and connections between higher education faculty and public school teachers.

5. Workshop sessions related to course revision activities, with the sessions including in-depth discussions of actual course examples of student work and opportunity for questions.

Other summaries of individual workshops and/or curriculum working groups included similar suggestions. The request for faculty development activities was a continuous one.

III. Evaluation to support faculty development and inter-campus collaboration

Prominent among the goals of the NYCETP were activities related to developing new courses and curriculum materials, as well as rethinking college instruction in line with the national standards in mathematics and science. In the spring of Year 1 evaluators reviewed the collaborative work to date and decided to attempt to focus the evaluation activities to actively promote very targeted NYCEPT goal. These goals were faculty development and intra- and inter-campus collaboration in developing courses and curriculum materials. Over the course of the next three years we developed several evaluation activities that supported both faculty development and inter-campus collaboration. These activities included the case study of courses, a related peer review process for course documentation, and a review form for student lesson plans developed in teacher education methods courses.

A. The case studies and peer review process of course documentation

We developed plans and procedures for cross-campus case studies of courses being revised and/or developed by NYCETP participants (Tittle, Pape, & Flugman, 2000). A case study strategy was deliberately designed to involve faculty in the same discipline area (i.e., science or mathematics) to talk one-on-one with another faculty member about a specific course. Although many of the conferences and workshops involved faculty presentations about a particular course or curriculum, there was not the detailed analysis of the context of the course, the students, and the curriculum that would be involved in a case study approach. Further, responses to evaluation feedback forms at these workshops and conferences confirmed that these activities provided formal and informal forums to converse about common ideas, issues, experiences and concerns. However, the activities left faculty expressing a number of needs. These needs included requests for: more information on strategies to change instruction; more feedback and guidance on changing course materials; more in-depth discussions of actual course examples (including student work); and opportunities to sit in on innovative math and inquiry-based courses as well as facilitation of inter- and intra-college faculty visits.

All of these evaluation feedback reports supported the decision to have the evaluation activities focus clearly on the goals of faculty development, specific courses, and the cross-campus involvement of faculty in a case study process. Our goals were: (1) to focus on key courses taken by teacher education students—whether in liberal arts and sciences (A & S) or education; (2) to have NYCETP faculty from one campus go to another campus; (3) where possible, to involve in each individual case study an A & S faculty member and an education faculty member; and (4) where possible, to have the faculty member observe an actual class in the course being case studied.. These goals have been meet to varying degrees in the case studies conducted over the five years of the project, as discussed below.

The case study process. The most frequent use of case studies in evaluation is illustrated by projects such as the one carried out by Stake and his colleagues (1993). In their project a group of evaluators very experienced in writing case studies in evaluation visited a series of NSF-funded projects in teacher education and wrote in-depth descriptions of each project for archival purposes. These descriptive documents are often considered "non-traditional" program evaluation (Frechtling. 1995), and are also more frequently used now in mixed method evaluations (Frechtling & Sharp, 1997). Case studies are valued for providing sufficient information that readers can form their own interpretations of the "case" being presented. Individual evaluators visit each project or case (or course in NYCEPT) and write a case study, much as an individual anthropologist or field-based researcher in sociology would do (LeCompte, Millroy, & Preissle, 1992).

In the context of NYCETP, we formalized the case study to some degree in order to assist faculty to focus on aspects of the course that met the NYCETP goals. We drew on earlier work (Tittle & Pape, 1996) to develop an outline for the case study. The purpose of the outline was to provide guidelines for faculty writing the case studies. The outline included the following categories: context, students-target population, faculty background, physical facilities, curriculum and materials, instructional methods, student outcomes and assessments, faculty roles, cross-discipline and field site collaboration and course revision plans. Both the year one outline and a revised outline based on faculty feedback are available in ERIC (Pape & Tittle, 1998).

The intent of the case study process was also to develop baseline reports that provided information about the courses before revision, as well as information on faculty practices and beliefs about teaching at that time. In the first year of the project the co-principal investigators of the six NYCETP campuses were asked to identify one or two courses on each campus for detailed documentation. They were also asked to identify faculty on their campuses who teach courses similar to those identified for study, to carry out the case studies, that is, to write a detailed description following the outline. The case study faculty then visited another campus to observe a class and meet with the course instructor to obtain details about the course curriculum, materials, instructional methods, student outcomes and assessments. Once the case study was written, it was sent to the evaluators, who reproduced copies and distributed them to the faculty participants, the NYCETP central office, and one to each campus co-principal investigator for the campuses involved in an individual case study.

Faculty participants in the case studies were given stipends of $750 to write a case study and $250 to be case studied. Faculty members who were teaching the courses were responsible for meeting with the faculty writer, collecting examples of course materials and student work, and clarifying aspects of the course as needed by the writer.

The case study outcomes and products: The Guidelines. Year one case studies were carried out for eight courses and involved 10 faculty, 3 in education and 7 in A & S on the six campuses. Three courses were offered in education departments, four in mathematics departments, and one in a science department. Year two case studies were carried out for four courses and involved 9 faculty (3 in education and 6 in A & S) on four campuses. Two courses were in science departments, one was in mathematics, and one in education. Year three case studies involved three courses and 6 faculty (1 in education and 5 in A & S) from 5 campuses. One course was in each area—education, mathematics, and science. Year 4-5 case studies were carried out for 5 courses, with 8 faculty (2 education and 6 A & S) involved. The faculty were from 5 campuses and a community college. One course was in an education department and four in departments of mathematics, including a community college department of mathematics.

Over the four years of the case studies all of the NYCETP campuses were involved at least once, and a community college was involved in the fourth and fifth years. Thirty-three faculty members participated across the four years and twenty courses were documented in the process. These courses were distributed across the areas of education (6), mathematics (10), and science (4). As these numbers show, the sciences were not as well represented as mathematics.

Following the first year's case studies, faculty were interviewed about the case study process. Faculty reported that the outline was useful and the interactions had facilitated collaboration across campuses and understanding of reform-based teaching and learning, in some instances. The in-depth visit on another campus assisted faculty to become clear about facilities that were necessary. One faculty member reported that she was better prepared to provide a request for space and materials than she had been prior to writing the case study. Others reported changes in thinking about course revisions, such as incorporating more computer graphics and simulations, evaluation of entrance requirements for courses, increasing collaboration among students, and using manipulatives as an integral part of a course, and the need for greater coherence between math and math education courses. One faculty member interviewed reported the difficulties inherent in collaboratively revising courses (i.e., A & S faculty and education faculty).

The case study documents are the primary outcomes of the case study process, and a related, peer review process was recommended and described in year two (Pape and Tittle, 1998). Although the peer review process was not carried out, a set of guidelines and forms developed for the peer review process were used. The NYCETP Guidelines for Self-Study of Course Documents/Curriculum was used in two ways. The first was in conjunction with faculty workshop/meetings discussing sample course documents and revisions. In this instance the Guidelines provided feedback to faculty. The second was with the course case study documents, and in this instance the Guidelines served to provide some indication of the fidelity of the course to national standards and NYCETP goals.

The Self-Study Guidelines included check lists and ratings on whether course documents/curriculum met the collaborative student-centered instructional goals, course content goals, course/materials minimum expectations, and evidence of effectiveness of goals in mathematics and/or science, including student attitudes or other outcomes. There were also ratings for CETP programmatic goals (e.g., collaborations, alternative assessments, partnerships, urban context, and dissemination goals). The Guidelines were accompanied by a glossary of terms. Ratings of 13 course revision documents were summarized at the end of year 3 (Pape & Tittle, 1998). The ratings provide some indication that these courses were more student centered—that is, there was at least some use of inquiry-based approaches, focus on deeper understanding, and/or an emphasis on problem solving and critical thinking.

Case study benefits. The outcomes described above do not adequately convey the richness, depth, and impact on faculty of some of the case studies. Qualitative outcomes provide another perspective on the benefits of the use of faculty case studies in evaluations. The examples here highlight the benefits of faculty case studies both to the individual faculty and to evaluators, as well as supporting the project goals as cited above.

In the 1996 first year case studies there were five faculty in mathematics and mathematics education who formed the beginnings of an enthusiastic working group in mathematics that met through the next two years of NYCETP activities. The individual meetings of pairs of faculty to discuss courses and common problems resulted in correspondence between them and sharing of course materials. In 1997 there was a case study of an exemplary collaboration between a mathematics faculty member and a high school teacher. The course, Sequential (high school) Mathematics from an Advanced Standpoint, was offered in the Department of Mathematics and Statistics, and was intended for students preparing to be high school mathematics teachers. The mathematics professor collaborated in the course development and was a participant observer for the duration of the course. The course instructor was the high school teacher who was writing an extensive document on the course development, syllabus, sample problems and student responses as part of the requirements for a masters degree. One of the formative evaluators visited the class in session, facilitated the adaptation of the masters project into a case study, asked the mathematics professor to write his substantive reflections on the course, and the evaluator also wrote an overview to the two documents. The case study process offered flexibility and the resulting documents have also been disseminated outside the NYCETP (NSF National Visiting Committee and Queens College).

In 1998 there were also two exemplary case studies, one in science and one in science/mathematics education. The weekly one-hour recitation for General Physics: Introductory Course in Mechanics, Heat, and Sound was case-studied by a physics professor from another campus. The recitation used Mathematica for a series of computer-based exercises with a focus on numerical solutions of physics problems. The case study offered the physicist an opportunity to thoughtfully place the use of Mathematica for exercises within considerations of physics as a science, traditional and reform-oriented physics education, and the goal of creative problem solving by analytical mathematics, potentially supported in the recitation exercises by numerical methods.

The second exemplary case study in 1998 was conducted by a professor in the Department of Mathematics and Computer Science, who visited a class and met with the education professor who developed the course, Applications of Microcomputers to Mathematics and Science Instruction, on another campus. The course is conducted with hands-on use of major aspects of computer technology, and a syllabus and web links for the class. Assignments included developing web pages, group projects, lesson plans, research paper or grant proposal, and used "tool software" as well as other instructional software, and was required for undergraduate students in the mathematics/science teaching programs. The course is highly praised by the computer science professor, who planned to disseminate information about the course/web site to education faculty at his own campus. The case study describes an effective integration of technology, instructional theory, and science/mathematics, including links with schools. The case study benefited the computer science professor, making clear the challenge of NYCETP goals: the course required both extensive knowledge of science and computer tools-applications, as well as continually evaluating new web sites and creating links to them. The course instructor's major goal was use of technology for enhancing student learning in mathematics or science. The qualitative outcomes of faculty learning and deepening understanding of the NYCETP and national standards in science and mathematics are clear benefits of using the case study process. These are intangible benefits that appear to derive from the faculty's exposure to other teaching examples and the use of case study writing to provide an opportunity to focus and reflect on the teaching and learning processes in classrooms similar to their own.

The major benefits for evaluators are "windows" into faculty course procedures and materials, as well as faculty reflections on courses other than their own. Further, the case studies provide sufficient detail that the NYCETP Guidelines for Self-Study of Course Documents/Curriculum can be used with the case studies. It is possible to make judgements about the extent to which courses meet NYCETP goals, as was done with the set of individual course documents prepared for the Collaborative. Overall, the use of faculty case studies provided benefits to faculty and evaluators, and supported overall NYCETP goals of collaboration between campuses and education/liberal A & S faculty.

Summary and implications of the case studies. The NYCETP formative evaluation has been innovative in asking university faculty interested in teaching to be involved in conducting case studies. The original evaluation impetus for the case studies was to provide baseline data on courses designated for reform, and then to restudy these courses when revisions were completed. This was an unrealistic expectation. However, the case studies do include several excellent examples of reform courses, although at least two of these course reforms were well underway when the collaborative began its first year. As mentioned above, the case studies provide sufficient detail for project staff, faculty, and evaluators to assess the fidelity of course reform to national standards and goals. As the Year 4 evaluation report notes, the case studies also illustrate the slow process of change in higher education and locate some of the institutional barriers to enhancing the quality of mathematics education for teachers in preparation—e.g., use of adjuncts for courses with many sections, variability in instruction among sections, including variability in modeling mathematics instructions for these future teachers.

One of the most positive outcome of the case studies was the cross-campus interaction among faculty, in depth, about individual courses. From the perspective of formative evaluation the case study process directly supported the NYCETP goals. The use of NYCETP faculty participants, particularly in the first year, did contribute directly to faculty improvement of their course development efforts. This result, along with somewhat similar work by Muller (1998), suggests that evaluators, particularly in the formative stages of projects, can add to project outcomes by developing strategies to directly involve participants (here, faculty) in the on-going work of evaluation. The extension of the case study outline into the peer review process of course evaluation, and into ratings of lesson plans (below), begins to provide a network of evaluation activities that support faculty development and can be transferred to on-going project activities if project leadership continues.

The implications from the evaluator's perspective are to make an active use of evaluation activities to involve program participants in developing and/or refining evaluation "tools" or instruments as well as using them. Well-structured, these evaluation activities and tools become a way to provide information and feedback for the participant's own use, as well as for evaluation.

B. The review form for student lesson plans: Pilot study

In the fifth year of the project evaluation, the NYCETP Guidelines for Self-Study of Course Documents/Curriculum were adapted and modified for review of lesson plans prepared by students in methods courses in elementary mathematics and/or science. The revised rating form was used in a pilot study with a small number of education faculty who were teaching methods courses. Again, the purpose of these guidelines for reviewing lesson plans was to focus on CETP goals and to provide a method for faculty and students to review their work, in this case for lesson plans.

There were two main purposes of the pilot study: (1) to determine if the peer review forms developed for the case studies could be adapted and used by faculty; and (2) to determine if a sample of the lesson plans developed in classes in mathematics and science education met the goals of the NYCETP, that is, the new standards in science and mathematics proposed by the National Council of Teachers of Mathematics (1989; 1991) and the National Research Council (1996).

Faculty were asked to collect student lesson plans and then to rate lesson plans from methods classes of other faculty. The full report (Scheiner & Tittle, 2000, and submitted to ERIC) describes (1) the procedures followed, (2) summary tables and findings for two sets of lesson plans rated by two faculty each, (3) a mini-case studies for four of these lessons, and (4) conclusions drawn from the pilot study of ratings of student lesson plans.

Procedures. In brief, the procedures included describing the project to the project directors on the six campuses of the NYCETP and requesting the names of faculty members who teach elementary education methodology courses in science and math and who agreed to be contacted for participation in a cross-campus project involving peer review of lesson plans. Participants would be paid $200 for their services. A list of eight faculty members was compiled, four in math and four in science.

Faculty were asked to select a sample lesson plan, rate another faculty's student lesson plan, and to evaluate/comment on the review form itself. The purpose of this first step was to evaluate the form itself. By November 1999, five participating faculty members had sent in a sample lesson plan written by one of their students. The collected lesson plans were then copied and one lesson plan was sent to each participant, along with an NYCETP lesson plan rating form and a glossary of terms. Five participants read the lesson they received, filled out the rating form, made comments on the lesson, and suggested changes for the rating form. The rating form was modified and five participants collected consent forms from their mathematics or science education methods' students and sent in a randomly selected sample of ten lesson plans from those consenting students (names removed for anonymity).

Not all faculty completed ratings and the pilot study results are based on two sets of mathematics lesson plans, for each of which we had two sets of faculty ratings completed by April 2000. The ratings were examined for the extent of agreement between the two raters, and to determine if there were disagreements on particular items on the rating form. These latter disagreements might indicate that certain items were ill-defined or that it was difficult to determine an element's presence in a lesson plan.

Findings. The two main purposes of the pilot study were to determine 1) the usefulness of the peer review forms for faculty ratings of lesson plans, and 2) the extent to which these small samples of lesson plans met NYCETP goals. With respect to the first question the pilot study provided evidence that the adapted peer review form was useful, and also that further revisions were needed. In particular, there were several items that were not consistently used by our small sample of mathematics education faculty, and indications that rater agreement varied as a function of the degree to which lesson plans were clearly exemplary or inadequate. The lesson plans selected for the case studies helped to clarify possible reasons for rater agreement and disagreement. Lesson plans at either extreme were consistently evaluated by both raters. Lesson plans that were not at the extremes and were lacking in detail presented an ambiguity that led raters to have different interpretations on some items.

With respect to the second question of lesson plans meeting NYCETP goals, there were clearly differences between the two sets of lesson plans from mathematics education classes. We used a stringent criterion—receiving an overall quality rating of good or excellent on any of the three major categories--to answer this question. Set 1 had only two lesson plans that were evaluated by both raters as good (3) or excellent (4) in one of the major categories reflecting NYCETP goals (Evidence of Effectiveness Goals, and Course/ Material Minimum Expectations). Set 4 had six of the 10 lesson plans that were rated good or excellent in at least one major category (A-Student-Centered Instructional Goals). Of these six lesson plans, two were rated good or excellent in all three of the major categories for which overall ratings were given. Although this is a small sample, it does suggest that the reviews of lesson plans could be used to examine the extent to which the lesson plans being developed in mathematics education classes were meeting Collaborative goals.

There are also a number of implications to be drawn from these admittedly limited data. Despite the extent of rater agreement described, these is a wide range in both the form and substance of lesson plans within these two sets. For a project such as NYCETP which is attempting to support the application of national standards in mathematics and science for teacher education students, student lesson plans provide an opportunity to incorporate a goals and standards-oriented framework for both teacher education faculty and students.

In our pilot study, the faculty of the methods classes use different directions for writing lesson plans. Other methods faculty undoubtedly have their own directions. A review form similar to the one used in the pilot study could be useful in faculty development and include practice in rating (as is done with raters of other text, e.g., essays), in order to have consistent agreement on the rating categories and definitions in the reviews. Also, it is likely that if more detailed review forms were provided to students, the lack of detail and ambiguity in lesson plans would be reduced and rater agreement would increase. Further, standards would be discussed and incorporated into student lesson plans. And, as was shown by one of the case study lesson plans, clarity, focus and meeting standards do not mean longer lesson plans. In summary, the pilot study of mathematics education faculty rating student lesson plans does suggest the potential uses for such a process in supporting the incorporation of standards and NYCETP goals as a valuable component of teacher education programs.

IV. Sixth Year Extension

The no-cost extension of the NYCETP for the 2000-2001 year has enabled three activities to be carried out by the Center for Advanced Study in Education:

- -- Planning and piloting design of an integrated student data base and tracking system;
- -- Participation in the NSF-funded University of Minnesota Core CETP data collection; and
- -- Development of a proposal for a CETP Institutional Focus summative evaluation Study.

All of these activities are continuations of the evaluation work developed by CASE over the five years of the NYCETP project.

A. An integrated student data base system

Throughout the five years of the NYCETP project there has been discussion of the problem of summative evaluation of the teacher education programs, including NYCETP programs. For the City University of New York there have been few resources that could be focused on the problems of assessment of teacher education students both during their training and once they were employed. New York State, however, has been making steady progress on the types of assessments used for qualifying teacher education students in basic skills, as well as the subject matter assessments and even videotaping of teachers on the job for provisional and "permanent" certification. The work of the state has been extended to the requirements of standards for teacher education students in basic competencies, and to placing teacher education programs on probation or discontinuing their status as certified programs if these standards are not met.

The New York State assessment program for teachers in preparation and for certification has meant that these evaluative assessments can be linked to the institutional data bases at each campus and the central office of the University Dean of Teacher Education. In effect, a meaningful student data base system can be developed for teacher education programs. In addition, the NY state requirement that teacher education programs choose one of the national accreditation bodies and receive national certification status has added to the efforts to extend a CUNY data base to include status and evaluation of the performance of program graduates in their employment as teachers, and as participants in graduate school teacher education. The National Council for Accreditation of Teacher Education, the accrediting body that will be used by CUNY teacher education programs, will eventually require the assessment of program graduates (NCATE 2000 Standards, May 11, 2000).

Thus, both state and national agencies requirements support the planning and pilot work that has been started this year for an integrated student data base system. These developments were discussed at meetings of the PI s of the NYCETP in the fall of 2000. The NCATE standards include the requirement that the teacher education programs have an assessment system and unit evaluations. A meeting was held later (Fall 2000) with CASE staff, the University-wide Dean for Teacher Education, and the University-wide Associate Dean for Institutional Research. This meeting focused on the NCATE requirements and their implications for teacher education programs, institutional research units on each campus, for the central offices of institutional research and teacher education, and for evaluations of specific initiatives such as NYCETP. Following further work and discussions with CUNY campus offices of teacher education, a plan was developed by the CASE evaluation team to help in designing the student data base (student tracking system) so that it could accommodate the collection of the University of Minnesota NSF core evaluation data for both pre-service students and employed teachers.

Further, both the work for the CORE NSF evaluation and the work on the integrated student data base project contributed to the development of the proposal for summative evaluation submitted to NSF in March 2001. These contributory linkages are described below.

B. Core CETP evaluation

NYCETP participation in the Core Evaluation Study conducted by the University of Minnesota involved three colleges. The surveys were administered in 19 classes that had participated in reforming their curricula in keeping with NYCETP criteria. Forms A and B were randomly administered within class and returned to CASE. Student surveys for 355 students were sent to the University of Minnesota.. The college student survey had several sections: demographic information; student perceptions of science and mathematics; and use of instructional strategies in the specific science, mathematics or education course in which the student was enrolled and surveyed. Data are reported below separately for forms A and B since the items on the forms differed. In particular, instructional strategies questions on form A asked if a strategy happened and if it did, *How helpful* was the strategy (not helpful, somewhat helpful, very helpful). Form B asked *How often* did you...? (seldom, occasionally, regularly, almost always).

The questions on the student surveys were linked to several CETP goals and national mathematics and science standards (Lawrenz, Huffman, Appeldoorn, & Sun, 2001). For example, students were asked how often they worked on problems related to real world or practical issues, performed investigative activities including data collection, whether they completed assessments or assignments that included portfolios and full-length papers, and about the use of technology in classes. In interpreting the student responses below, the type of courses in which students were enrolled is very relevant. The 19 classes in the NYCETP sample includes 18 courses taught in science and mathematics departments (Schools of Liberal Arts and Sciences), of which two are cross listed with the School of Education. One course is taught in a School of Education. Thus the student responses need to be considered in terms of their experiences in mathematics and science courses taught by faculty in the Liberal Arts and Sciences.

Results. Response percentages were tabulated for all questions in student surveys A and B. These results are presented in Appendix A. Table 1 presents percentages for selected demographic questions, Tables 2 and 3 for student perceptions regarding mathematics and science, and Tables 4 and 5 for instructional strategies. Table 6 presents results for selected instructional strategies where students indicated that the strategy was implemented in their class. The nine instructional strategies in Table 6 were selected because they are important NYCETP and national standards goals and aims for classroom instruction in science and mathematics.

Table 1 demographics show that 70% of the students are in their junior or senior year. The majority of the sample, 76% of survey A (n=180) and 78% of Survey B (n=175), indicated that they intend to become licensed as a teacher. When asked the question, Why are you taking this course? (check all that apply), 78% indicated that, "It is required by my major," and 64% checked, "Meets a general education requirement." Only 10% reported that they were taking the course because they are interested in it.

The responses to questions on perceptions about mathematics and science are reported in Tables 2 and 3. Almost all students, 94%, agreed or strongly agreed with the statement, "There are many methods of solving scientific problems." And, about 80% disagreed or strongly disagreed with the statements that suggested that special abilities were required to truly understand mathematics or science in math and science classrooms.

Table 4 presents response percentages, means and ranks for instructional strategies that may have been implemented in the courses and, if so, the degree to which they were helpful. On average, across courses and strategies, students indicated that instructional strategies were implemented about 66% of the time. This figure reflects an average of the response percentages in the "Did Happen" categories in Table 4.

The instructional strategies were rank ordered in terms of the percentages in the "very helpful" category, and the highest percentage received a ranking of one. The four highest-ranked strategies received ratings ranging from 40% to 48% in the "very helpful" category: Writing descriptions of your own reasoning; Basing new information on what students already know about the topic; Performing investigative activities that included data collection, analysis and various types of representation; and Working on problems related to real world or practical issues. The percentages for these data were also examined by adjusting the percent base by deleting the number of students who reported this did not happen in their classroom. The adjusted percents on degree of helpfulness of the strategy are described for students experiencing the strategies (see below and Table 6).

The results in Table 4 also provide information on strategies reported as not implemented in the classroom ("Didn't Happen"). Data in Table 5 are generally in agreement with the data reported in Table 4, and they expand the ratings in terms of frequency of occurrence (from Seldom to Almost Always). Notable are the low uses of technology in instructional strategies in both Tables 4 and 5. While these data range from about 35% to 49% in the "Didn't Happen" category for Table 4, Table 6 gives a very positive picture of what happens when technology is used.

For those who reported that technology was used, the overwhelming majority of these students (89-95%) rated the uses as Somewhat or Very Helpful for three uses:

To understand or explore in more depth concepts used in class (89%)

To learn new information (92%)

As a tool in investigations to gather and analyze scientific or mathematical data (95%)

Similar positive ratings occur for other major goals of current CETP reform efforts. Table 6 presents selected instructional strategy goals where, again, of those who reported that the strategy was implemented, over 80% indicated that it was Somewhat or Very Helpful:

Participating in whole-class discussions during which the instructor talked less than the students (82%)

Writing descriptions of your own reasoning (92%)

Working on problems related to real world or practical issues (97%)

Performing investigative activities that included data collection, analysis, and various types of representation (95%)

Designing and making presentations that help you learn class concepts (89%)

Completing assessments/assignments that included problems with complex solutions (87%)

There were a few instructional strategies in the assessment category (Table 4) that over half the sample indicated did not happen: Completing assessments/assignments that included-- 1) portfolios (63%), and 2) full-length papers (56%).

Overall, the student survey data provide some evidence that CETP goals are being met to an encouraging degree, particularly since the sample consists primarily of students in courses taught in departments of mathematics and sciences. For example, Table 5 presents data that over half of the students (Regularly plus Almost Always) do the following: Write descriptions of your own reasoning (58%); Work on problems related to real world or practical issues(58%); and Perform investigative activities that included data collection, analysis, and various types of representation (54%). About half the students (49%) also complete assessments/assignments that include Problems with complex solutions. Similarly encouraging are the responses of students who have these experiences. They are very positive for many of the CETP goals, as indicated by the data described (above, Table 6).

C. NYCETP Summative Evaluation Proposal

In March 2001 a proposal, *A Follow-up Summative Evaluation of the New York Collaborative for Excellence in Teacher Preparation,* was submitted to the NSF CETP-Institutional Focus unit. The research and evaluation project is designed to examine the effects of training teachers to provide mathematics and science instruction aligned with newly established content and pedagogical standards. Teacher education students on three campuses of the NYCETP will be involved. These K-6 students will be tracked longitudinally for three years—the last two years of college and the first year of employment The tracking procedures will be part of those established following on the NYCETP sixth year extension that involved CASE in planning for an integrated student data base and tracking system. Many of the assessment procedures will draw on the University of Minnesota CORE Student Survey and Teacher Survey. Performance on New York State Teacher Certification examinations in mathematics and science will assess teacher candidate knowledge. Actual teacher performance in classrooms will be assessed by the University of Minnesota Core Classroom Observation Protocol.

The study will involve 175 students who are taking CETP courses in the three urban colleges as preparation for K-6 teaching. These students will take from 2 to 8 CETP reformed courses in mathematics/science and teacher education. A comparison group will be constructed from students attending the same colleges who have been waived out of CETP reformed courses because they are transfer students or because they already have obtained a baccalaureate degree. It is estimated that there were be about 30 of these comparison students per college, and about 60 CETP students per college for two years of the study. A smaller random sample of 40 CETP teachers and 40 waived comparison (non-CETP) teachers will be observed in their first year of teaching.

Specific research questions to be examined in the proposed study include: How does the CETP treatment group compare to the non-treatment group on assessments of knowledge, attitudes and self-reported teaching strategies? Are teacher education students at different levels of academic ability affected differentially as a function of their CETP/non-CETP participation? To what extent does the treatment group' performance in the classroom change over time (from student teaching to employment) as a function of CETP involvement compared to the non-treatment group? The proposed study is important to contributing to the understanding of how new approaches to teacher training (CETP) can meet the pressures of urban school environments. Further, the proposed study will empirically model the use of a comprehensive teacher education tracking system.

Overall, the sixth-year extension of the evaluation component of the NYCETP project has enabled progress to be made on planning and designing an integrated student data base and tracking system that will continue at the City University of New York on an institutional basis. The system will encompass all the senior colleges of the City University that offer teacher education program. The majority of graduates of these programs enter urban schools, and NTCETP will have a continuing impact on the improvement of NYC schools.

V. Summary and implications

The New York for Collaborative for Excellence in Teacher Preparation (NYCETP) formally concluded in July 2001. The project included four years of developmental activities, a fifth year of dissemination activities, and a sixth year extension to complete dissemination, project and evaluation reports, participate in the CORE NSF evaluation data collection, and develop a longitudinal research/evaluation proposal of a student cohort at three college campuses of the City University of New York. The Center for Advanced Study in Education (CASE) was the internal evaluation contractor for NYCEPT, and carried out on-going formative evaluation activities during the five years of the project, as well as several of the sixth year extension activities (described earlier).

During years 1-4 the meetings of the Principal Investigator and the co-Principal Investigators from the participating colleges were attended and documented by CASE staff. Faculty meetings in working groups and conferences were attended and feedback surveys carried out and reported. The pattern of activities for the first three years included faculty workshops and, in years two and three, faculty curriculum working groups, as well as at least one large conference each year. The pattern of attendance for each of these activities was one of decreasing attendance with each succeeding year. A distinct exception was the second year large conference held at the New York Hall of Science in Queens, on *Mathematics and science for all: How informal science-rich institutions can contribute to national reform efforts in mathematics and science.* This conference was attended by 161 public school, university, and museum personnel, including students. A somewhat similar pattern held for the case studies initiated by the evaluators. The greatest number of faculty and courses were involved in year one, in which 8 NYCETP 'reform' courses were documented, with 10 participating faculty. Year 2 involved four courses and 9 faculty, year 3 involved 3 courses and 6 faculty, and years 4-5 involved 5 courses and 8 faculty. Faculty in science, mathematics and education were involved in all of these case studies, as well as faculty across the participating campuses of the collaborative. In all, 33 faculty participated, 20 courses were documented, and the courses were distributed across the areas of education (6), mathematics (10), and science (4).

The NYCETP had many diverse yet related goals intended to enhance the preparation of teachers at the six campuses. While many of the course development activities and case studies were carried out across campuses, other activities tended to be more involving of individual campuses. This was true for activities related to the teaching scholars, providing student supports and career development, developing exemplary field sites and involving master teachers, and recruiting students. There were three issues of a collaborative publication, *Connect* (1995-spring 1997), and one issue of a newsletter, *NYCETP News* (fall 1997, beginning of the third year of the Collaborative). In 1999-2000 there was a web site at Brooklyn College, and a publication was prepared, *Faces of Reform: Snapshots of exemplary MST activities of the New York Collaborative for Excellence in Teacher Preparation.* A broader dissemination of some of the activities was targeted in another publication, a special issue of the *Journal of Mathematics and Science: Collaborative Explorations* (Vol. 3, 1, Spring 2000).

Overall, the NYCETP achieved some of its extensive goals. The core goals of reform in mathematics and science courses, and the related education courses should be sustained and continue to expand. This will primarily be due not only to NYCEPT but also the context in which it was situated. The state of New York has been active in reforming teacher certification and programs of teacher education. Requirements for change in certification programs include many of the CETP goals of education, as well as requirements for mathematics and science faculty working together to improve teacher preparation courses. The NY State Standards for K-12 students emphasize many of the same goals as the national standards movements in mathematics and science. State assessment programs for teacher education students and teacher certification have been implemented and standards set on these assessments. All teacher education programs have been required to revise their programs in line with these goals and processes. Colleges and universities must submit their programs for re-certification, as well as prepare and obtain certification from a national board of certification, such as the National Council for Accreditation of Teacher Education. While NYCETP has contributed to meeting all of these contextual demands, all of these situational pressures will in turn help to ensure that the goals and activities of the NYCEPT continue in some form in the six campuses that constituted the Collaborative.

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APPENDIX A

Table 1
Demographics of College Student Surveys A and B: Response Percentages

	Survey A (N=180)	Survey B (N=175)
Institution:		
College (1)	48.3	47.4
College (2)	49.5	50.3
College (3)	2.2	2.3
Gender:		
Male	17.6	-
Female	82.4	-
Classification year:		
First year	-	6.9
Sophmore	-	22.0
Junior	-	27.7
Senior	-	42.2
Graduate	-	.6
Non-degree/licensure	-	.6
Age		
17-21	-	51.0
22-26	-	29.9
27-32	-	7.0
33-37	-	8.3
38+	-	3.8
Do you intend to become licensed as a teacher:		
Yes	76.0	78.0
No	24.0	22.0

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Table 1

	Survey A (N=180)	Survey B (N=175)
Are you already participating in a teacher preparation program:		
Yes	50.6	47.0
No	49.4	53.0
If you are particpating in a teacher preparation program:		
How would you rate the level of quality of your courses and practicum experiences? (n=97)		
Less than adequate	6.2	-
Adequate	57.7	-
More than adequate	27.9	-
Exceptional	8.2	-
Are the teaching methods used in this class similar to those presented in your methods courses? (n=97)		
Yes	-	39.2
No	-	60.8
Do you have a scholarship provided by a Collaborative for Excellence in Teacher Preparation (CETP) or the National Science Foundation (NSF)?		
Yes	1.7	1.8
No	98.3	98.2

Note: (-) indicates that no data is available for that question.

Table 2
College Student Survey A: Perceptions
Response Percentages and Means (N=180)

Please darken one circle for each statement below.

	Strongly Agree	Agree	Disagree	Strongly Disagree	Mean*
The truth of scientific knowledge is beyond doubt.	6.8	52.0	33.3	7.9	2.42
There are many methods of solving scientific problems.	32.4	62.0	4.5	1.1	1.96
Truly understanding science in the science classroom requires special abilities that only some people possess.	3.4	15.2	55.6	25.8	3.04
Truly understanding mathematics in the mathematics classroom requires special abilities that only some people possess.	4.4	15.0	55.6	25.0	3.01

*Note: The mean is derived from responses that are coded from 1 to 4 with "1" representing "strongly agree" and "2" representing "agree", and so on.

Table 3
College Student Survey B: Perceptions
Response Percentages and Means (N=175)

You must choose the single best answer-darken one circle only.

	Response Percentage
In deciding whether or not a proposed theory can be accepted, scientists will probably make their decision on the basis of:	
a. Whether or not the theory is true.	4.7
b. Whether or not the theory can be expressed in mathematical form.	5.2
c. The evidence supporting the theory and their personal ideas.	22.8
d. The experimental and observational evidence available.	67.3
*Mean: 3.53	
Most important scientific advances have come about as a result of:	
a. The development of new and more scientific sets of ideas.	22.5
b. The interaction of ideas and experiments in the solution of problems.	52.7
c. The dedication of an extraordinary person to the investigation of a particular specialty.	4.7
d. An interaction between a chance observation of a new phenomenon with an alert mind.	20.1
*Mean: 2.22	

*Note: the mean is derived from responses coded from 1 to 4 with "1" representing choice "a" and "2" representing choice "b", and so on.

Table 4
Instructional Strategies: Survey A
Response Percentages, Means and Ranks

The following items represent dimensions of instruction that might have been implemented in this class. If particular instructional strategies were not implemented, please check "Didn't Happen". If they were implemented, please indicate the degree to which the strategies were helpful to you in learning course concepts and content. Darken one circle for each item.

		Did Happen				
	Didn't Happen	Not Helpful	Somewhat Helpful	Very Helpful	Mean[a]	R[b]
Working with other students where the whole group gets one grade?	48.9	7.8	25.0	18.3	2.1	19.0
Participating in whole-class discussions during which the instructor talked less than the students?	25.8	13.5	34.9	25.8	2.6	13.0
Writing descriptions of your own reasoning?	12.4	6.8	41.3	39.5	3.1	4.0
Working on problems related to real world or practical issues?	10.2	2.8	39.0	48.0	3.3	1.0
Performing investigative activites that included data collection, analysis, and various types of representation?	23.7	4.0	31.6	40.7	2.9	2.0
Making connections to to other SMT* and non-SMT*fields ? (*science, mathematics and technology)	27.7	5.6	38.5	28.2	2.7	9.0
Designing and making presentations that help you learn class concepts?	45.4	5.7	25.9	23.0	2.3	14.0
Evaluating the extent of your own learning?	17.7	5.7	40.0	36.6	3.0	5.0
Having a voice in decisions about course activities?	27.1	10.2	29.4	33.3	2.7	7.0
Basing new information on what students already know about the topic?	13.3	8.1	38.7	39.9	3.1	3.0
Using student assessment results to modify what was taught and how?	28.0	8.9	36.3	29.8	2.7	8.0

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Table 4

	Didn't Happen	Did Happen: Not Helpful	Did Happen: Somewhat Helpful	Did Happen: Very Helpful	Mean[a]	R[b]
Completing assessments/assignments that included:						
problems with complex solutions?	22.9	9.7	40.5	26.9	2.7	11.0
portfolios?	62.6	5.3	19.5	12.6	1.8	21.0
multiple choice/short answer items	37.9	5.0	36.2	20.9	2.4	16.0
full-length papers?	56.5	9.4	18.8	15.3	1.9	20.0
Using technology, e.g., computers, calculators:						
to practice skills learned in class?	43.3	5.0	31.5	20.2	2.3	18.0
to understand or explore in more depth concepts learned in class?	37.6	6.8	33.1	22.5	2.4	15.0
to learn new information?	34.6	5.1	26.8	33.5	2.6	6.0
as a tool in investigations to gather and analyze scientific or mathematical data?	37.9	2.8	31.6	27.7	2.5	10.0
as a tool to prepare written reports or presentations?	48.9	2.2	22.2	26.7	2.3	12.0
as a tool for assessment?	42.2	5.0	32.2	20.6	2.3	17.0

[a]The mean is derived from responses coded on a 1 to 4 scale with "1" representing "didn't happen" and "2" representing "not helpful", and so on

[b]A ranking (R) of "1" indicates that this item received the highest percentage of respondents reporting that this strategy was implemented and was "very helpful" in this course. A ranking of "2" indicates that this item received that second highest percentage of respondents reporting thatthis strategy was implemented and was "very helpful" in this course, and so on.

Table 5
Instructional Strategies: Survey B
Response Percentages, Means and Ranks

The following items represent dimensions of instruction that might have been implemented in this class. Please respond how often you were asked to do each of the items. Darken one circle for each item.

How often did you?

	Seldom	Occasionally	Regularly	Almost Always	Mean[a]	R[b]
Work with other students where the whole group gets one grade?	42.9	32.9	15.4	8.8	1.9	21.0
Participate in whole-class discussions during which the instructor talked less than the students?	21.3	41.4	25.5	11.8	2.3	12.0
Write descriptions of your own reasoning?	11.9	29.8	35.1	23.2	2.7	6.0
Work on problems related to real world or practical issues?	10.8	31.6	38.0	19.6	2.7	1.0
Perform investigative activites that included data collection, analysis, and various types of representation?	20.3	25.6	37.2	16.9	2.3	4.0
Make connections to to other SMT* and non-SMT*fields ? (*science, mathematics and technology)	27.4	29.8	29.7	13.1	2.3	10.0
Design and make presentations that help you learn class concepts?	44.1	27.3	19.9	8.7	1.9	17.5
Evaluate the extent of your own learning?	21.1	30.4	34.5	14.0	2.4	7.0
Complete assessments/assignments that included:						
problems with complex solutions?	20.6	30.0	37.6	11.8	2.4	2.0
portfolios?	56.6	21.7	16.3	5.4	1.7	20.0
multiple choice/short answer items?	38.0	24.5	24.6	12.9	2.1	13.0
full-length papers?	44.8	23.3	19.0	12.9	2.0	19.0

Page 2
Table 5

How often did you?

	Seldom	Occasionally	Regularly	Almost Always	Mean[a]	R[b]
Use technology, e.g., computers, calculators:						
to practice skills learned in class?	37.5	32.8	23.2	6.5	2.0	16.0
to understand or explore in more depth concepts learned in class?	28.1	33.6	26.3	12.0	2.2	11.0
to learn new information?	27.6	26.5	31.8	14.1	1.0	9.0
as a tool in investigations to gather and analyze scientific or mathematical data?	31.8	34.1	23.5	10.6	2.1	14.0
as a tool to prepare written reports or presentations?	38.0	21.6	23.4	17.0	2.2	15.0
as a tool for assessment?	44.1	27.3	19.9	8.7	2.0	17.5
How often?						
Did students have a voice in decisions about course activities?	17.0	31.0	35.6	16.4	2.5	5.0
Was new information based on what students already know about the topic?	14.5	39.5	32.0	14.0	2.5	8.0
Were student assessment results used to modify what was taught and how?	21.4	30.4	37.5	10.7	2.4	3.0

[a]The mean is derived from responses coded on a 1 to 4 scale with "1" representing "seldom" and "2" representing "occasionally", and so on.

[b]A ranking (R) of "1" indicates that this item received the highest percentage of respondents reporting that this strategy was implemented "regularly" in this course. A ranking of "2" indicates that this item received that second highest percentage of respondents reporting that this strategy was implemented "regularly" in this course, and so on.

Table 6
Selected Instructional Strategies: Survey A
Response Percentages and Means

The following items represent dimensions of instruction that might have been implemented in this class. If particular instructional strategies were not implemented, please check "Didn't Happen". If they were implemented, please indicate the degree to which the strategies were helpful to you in learning course concepts and content. Darken one circle for each item.

	Not Helpful	Somewhat Helpful	Very Helpful	Mean[a]
Participating in whole-class discussions during which the instructor talked less than the students? (N=132)	18.2	47.0	34.8	3.2
Writing descriptions of your own reasoning? (N=155)	7.7	47.1	45.2	3.4
Working on problems related to real world or practical issues? (N=159)	3.1	43.4	53.5	3.5
Performing investigative activities that included data collection, analysis, and various types of representation? (N=135)	5.2	41.5	53.3	3.5
Designing and making presentations that help you learn class concepts? (N=95)	10.5	47.4	42.1	3.3

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Table 6

	Not Helpful	Somewhat Helpful	Very Helpful	Mean[a]
Completing assessments/ assignments that included:				
problems with complex solutions? (N=135)	12.6	52.6	34.8	3.2
Using technology, e.g., computers, calculators:				
to understand or explore in more depth concepts taught in class? (N=111)	10.8	53.2	36.0	3.3
to learn new information? (N=117)	7.7	41.0	51.3	3.4
as a tool in investigations to gather and analyze scientific or mathematical data? (N=110)	4.5	51.0	44.5	3.4

[a]The mean is derived from responses that are coded on a 2 to 4 scale with "2" representing "not helpful, "3" representing "somewhat helpful" and "4" representing "very helpful".

Note: Response percentages include only those respondents who reported that a particular strategy was implemented.

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